Remarks for the U.S.-China Economic and Security Review Commission
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I am pleased to submit these remarks to the Commission. I believe that the many issues involving energy use in China are of great importance not only to China but also to the United States and the rest of the world. I am strongly of the opinion that many interests are served by supporting China in its efforts to reduce growth of energy demand. As a result of this belief, we have worked hard over the years to collaborate with China – especially providing information and knowledge – to assist its policy and policy research community in pursuing energy efficiency.

Before addressing the specific questions you have raised, let me provide some background

I submit as an Attachment the statement of Steven Chu, Director of Lawrence Berkeley Laboratory, before the United States Senate Committee on Finance on March 27, 2007. The subject of the testimony was "Opportunities and Challenges in the U.S.-China Economic Relationship." Some of the most important points that he made in this testimony are in my view:

- The importance and impact of both China's and the United States' growing reliance on coal
- China's desire to guarantee access to its future oil and natural gas supply, which can but does not need to lead to conflicts between the countries
- Growing concern in the United States about particulates from China in the Sierra Nevada Mountain Range (which I believe Jane Long will discuss in her testimony)
- The recognition that almost half of all CO_2 emissions are from two countries: China and the United States
- The key question for China: can it return to its highly successful program that ran from 1980 to 2000 in which energy growth was half of GDP.

On this last topic I note that the growth of energy demand has been as high as 1.5 times GDP in several of the recent years. China's government is now embarking on a very ambitious program to reduce energy intensity by 20% in five years. Current information indicates that it will be very difficult to achieve these goals, but it is clear that China is devoting considerable effort to reining in energy demand growth.

I urge members of the Commission to read this testimony in full, as I believe it provides valuable insight into its chosen topic.

The Lab Perspective on the Global Energy Future and How this Affects its Research Priorities

I am representing my own perspective on this question, but I believe it is consistent with that of LBNL. There are two critical issues facing the world that are intimately tied to energy. They are the need for carbon neutral fuels to avert global climate change and as a substitute to existing sources of liquid fuels. These concerns have had a profound effect on the research at LBNL. The Director has initiated a major effort called the Helios Project that is applying basic science to these problems. He is engaging an important part of the intellectual resources of the research community here in this research. In short, the global energy future and the problems it presents have become a very strong motivator of the work we do and increasingly serve to define that work.

Past and Current Research Exchanges

The major collaborations between China and LBNL in energy have been through the China Energy Group, which has had a continuous relationship with China since 1988. The group numbers about six staff members.

The China Energy Group works collaboratively with energy researchers, suppliers, regulators, and consumers in China to better understand the dynamics of energy use in China, and to develop and enhance the capabilities of institutions that promote energy efficiency in that country. We have established a network of collaborative agreements in China, including the Energy Research Institute of China's National Development and Reform Commission, Beijing Energy Efficiency Center, China National Institute of Standardization, China Center for the Certification of Energy Conservation Products, the Ministry of Construction, and other research organizations in China, central and local government offices, and enterprises. Our projects – supported mainly by the U.S. Energy Foundation, the Environmental Protection Agency, and the Department of Energy – have also led to cooperation with other national laboratories, U.S. businesses, non-governmental organizations, foundations, and multilateral agencies.

Building Standards

Building energy standards are important in China for a variety of reasons:

- China is currently building roughly half of the new construction in the entire world.
- The energy used by the building sector is further compounded by the increased demand for space conditioning
- The energy use intensity in Chinese buildings still remain low compared to that in the West, despite their relatively poor thermal integrity; this means that should occupant expectations for thermal comfort approach that in the West, building energy use in China would increase substantially.

The Ministry of Construction (MOC) is responsible for regulating the building industry in China, including the development of standards, guidelines, and incentive policies to promote building energy efficiency. Starting in the mid-90's, with technical assistance from LBNL, the MOC has developed building energy standards for all parts of the

country covering both residential and public (or commercial) buildings. The public building energy standard was completed in 2004, and the residential building energy standards, the last being completed in 2003, are now being updated into a National Code, due for completion in late 2007. Enforcement of building energy standards has been steadily strengthened, with compliance rates estimated at 60% in major cities in the north, and lower but rising in the south. In 2006, the MOC has also developed a Green Building Rating System, and is now (2007) working on an energy rating system for all residential buildings. LBNL was also a key participant in the development of China's new window efficiency rating system.

The stated objectives of the current building energy standards are to reduce building energy use by 50% compared to standard construction before the standard, rising to 65% reductions in major cities such as Beijing and Tianjin. These projected savings, however, are based on engineering calculations using standard operating conditions that do not account for poor or inadequately heated or cooled conditions in typical buildings. As a result, the base case energy consumptions are much higher than measured actual usage, particularly for cooling, making the projected energy savings overly optimistic. Actual energy savings between code compliant and pre-code buildings is expected to be a third or less of the projected savings. These savings are further degraded depending on the level of non-compliance, which is significant, particularly in the South.

Appliance Standards and Labeling

China is currently one of the world's largest producers and consumers of appliances, such as refrigerators, air conditioners, televisions, washing machines and consumer electronics. The explosive increase in ownership of these appliances has underpinned the 16% annual average growth in electricity consumption in China's residential sector. LBNL has collaborated with and provided technical assistance to China's efficiency standards and labeling organizations since the late 1990s, introducing a new approach to the development of standards and efficiency labeling criteria, largely modeled on the US DOE and EPA approaches.

In total, LBNL has assisted China in the development of 11 minimum appliance efficiency standards, including refrigerators, air conditioners, fluorescent lighting, clothes washers, gas water heaters, and other products; and of 10 efficiency criteria for China's voluntary labeling program, covering printers, computers, fax machines, televisions, among others. As the program in China has grown and matured, LBNL has provided assistance to develop China's first government energy efficiency procurement policy, similar to the US Federal Energy Management Program, and is currently working to develop policies and programs for more stringent enforcement of appliance standards. As part of China's effort to reduce the energy intensity of its economy by 20% by 2010, LBNL is also assisting selected provinces to accelerate their adoption of future efficiency standards.

A recent evaluation of the effectiveness of this program looked at the energy and GHG savings from a selection of 11 products now subject to standards and labeling. The assessment found that the program reduces total electricity consumption in 2020 by an annual 106 TWh, or 16% of what would otherwise been expected in that year in the absence of standards and labeling programs. On a cumulative basis, the program is

expected to save 1143 TWh by 2020, or 9% of the cumulative consumption of residential electricity to that year. Savings in CO2 emissions are expected to reach a cumulative 300 million tons carbon equivalent by 2020.

Industrial Energy Efficiency

China's industrial sector, which accounted for 64% of the nation's total energy consumption in 2005, includes a large and growing domestic market as well as its more visible role as an essential part of the US supply chain. Chinese industry provides materials such as steel and cement that build the nation's roads, bridges, homes, offices and other buildings. Industrial products for both domestic use and export include bicycles, cars, buses, trains, ships, office equipment, appliances, furniture, packaging, pharmaceuticals, and many other components of everyday life in an increasingly modern society. This vital production of materials and products, however, comes with considerable problems. China's industrial sector is heavily dependent on the country's abundant, yet polluting, coal resources. Industrial production locally pollutes the air with emissions of particulates, carbon monoxide, sulfur dioxide, and nitrogen oxides, uses scarce water and oil resources, emits greenhouse gases contributing to the warming global atmosphere, and often produces hazardous and polluting wastes.

LBNL has been working with industrial sector experts in China for many years to explore options for industrial energy efficiency policies, providing information on programs that are effective in other countries and that may be suitable for the increasingly market-based industrial sector in China. LBNL's current work includes examining energy efficiency trends in China's key industries, benchmarking China's major energy-consuming industries to world best practices, providing technical information on energy efficiency opportunities for key industries, adapting software tools and demonstrating energy auditing processes for improving energy efficiency, coordinating on energy management standards and practices, and providing technical assistance related to implementation of energy efficiency programs – especially the recently announced Top-1000 Energy-Consuming Enterprises Program.

The goal of the Top-1000 Energy-Consuming Enterprises program is to realize savings of 100 Mtce (2.8 Quads, 2.9 EJ) from the expected 2010 energy consumption of these 1000 enterprises. If successfully implemented, the Top-1000 Program would be the world's single most ambitious energy efficiency program. The carbon dioxide emissions reduction potential of the Top-1000 program—nearly 250 MtCO2—is significant. For comparison, energy-related carbon dioxide emissions for all of the countries participating in the Kyoto Protocol are projected to be reduced by 422 MtCO2 by 2010.[1]

[1] U.S. Energy Information Administration, 2006. *International Energy Outlook.* http://www.eia.doe.gov/oiaf/ieo/emissions.html

China's primary energy consumption more than doubled between 1990 and 2005. In 2002 energy consumption growth surpassed GDP growth with the expansion of heavy industry. The LBNL China Energy Group tracks and addresses these trends through its data collection and policy analysis activities. In addition to quantifying energy system growth trajectories, the Group uses its extensive database to explore the effects of new policies and emerging resource constraints on China's energy system development.

The LBNL China Energy Group's recent policy and research activities can be summarized with a brief overview of three recent activities. In 2004, the Development Research Center published a study exploring options for a national energy strategy: China National Energy Strategy and Policy 2020 (NESP). The next year LBNL published an assessment of the policies and long-term targets presented in this document entitled "Evaluation of China's Energy Strategy Options". Another example of LBNL's energy policy research is the Group's analysis of options for China to achieve its target of reducing the energy intensity of its economy by 20% by 2010. We found, and Chinese researchers have since confirmed, that energy efficiency alone will not be sufficient to achieve the targets. Energy efficiency is needed to play a significant role. But industrial restructuring, in favor of light industry, will also be needed. Regarding data collection, the Group's activities are exemplified by the compiling of Version 7 of the China Energy Databook, which will incorporate energy and GDP revisions announced by China's National Bureau of Statistics, as well as data from a very broad variety of sources. Version 6 of the Databook was requested by more than 1,600 government, company, university and other research organizations throughout the world. Through these activities, the LBNL China Energy Group seeks to broaden understanding and highlight opportunities for cooperation with China on energy.

Perspective on opportunities for U.S.-China cooperation in R&D on energy technologies; impact of new technologies

As I have noted earlier, the U.S. and China together consume almost 50% of global energy, a fraction that will grow in future years. Cooperation in the development and application of energy technologies between the two countries is can contribute in important ways to the solution of the energy problems that we have in common.

The example of the joint work on energy efficiency provides valuable lessons. The Chinese were quick to recognize the benefits of energy efficiency. After only a few years of working with LBNL, the Chinese government set up not one but two institutes to address energy efficiency in appliances: one to develop energy efficiency standards and a second to create energy labels. These institutes are funded and carrying out important work, with much reduced need for input from us. The lesson here is that China has an ability to translate research into action.

It is also interesting to note that China has been highly creative in addressing energy efficiency implementation issues. I mention two examples. China set up an organization, the China Energy Conservation Investment Corporation, that was devoted solely to investing in energy efficiency in 1980. This played an important role in bringing

investment to energy efficiency that had never happened before. A second example is the creation of energy efficiency centers throughout China to deliver services to local industries. Thus industries had access to specialists who could implement energy efficiency measures.

The importance of China reducing growth of greenhouse gas emissions provides added reasons for the United States and China to work together. In the same way that we worked with China on appliance standards, a major effort that addresses industrial energy efficiency could have significant impact in reducing emissions from industry. China has demonstrated an openness to ideas from outside, even when the solution is adapted to the Chinese circumstances. China, in its recent release of its Climate Change Plan, has acknowledged the importance of climate change and seeks collaboration in areas that can provide technology to reduce emissions.

In some cases, because of the size of their markets, China can serve as an experimental test bed for advanced technologies that can lead to large markets. This is already taking place in a number of areas, including renewable energy technologies and coal gasification. In my view both parties have much to benefit by cooperating in such activities as energy efficiency, various renewable energy technologies, carbon sequestration, integrated combined cycle coal gasification, recovery of methane from coal beds and coal mines, and nuclear power. These are all crucial technologies to address climate change, and the United States and China are the two largest emitters in the world.

It may be necessary to find original ways of addressing intellectual property for joint research, development, and demonstration efforts to proceed most effectively. Interestingly, the IP issues may be different in nature from those that have traditionally been important in dealings with China and other developing countries: our need to have our IP respected. In some of these energy technologies, it is reasonable to assume that China is aggressively pursuing IP for its own uses. It has a huge domestic customer base and can use this base to scale up enterprises for export. As China develops its own IP for advanced energy technologies, it has a greater incentive to see its IP protected. This can provide an incentive for China to strengthen its regime for respecting IP of other nations.

Joint R&D provides for sharing of IP. Shared IP for energy technologies by the two largest consumers of energy could serve to spur new technology development to address the twin problems of global warming and carbon neutral liquid fuels.

I believe that the discussion above makes clear my belief that our efforts to develop new energy technologies will play a major role in our future well-being as a nation. It is critical to our energy future. Our energy future is critical in to our economic and environmental future. We will not solve our liquid fuel problem without radically different technologies. We will not address global warming without new technologies. We require new energy technologies to address these problems.

I thank the Commission for the opportunity to share with you our work on China, the views of the Director of LBNL on Opportunities and Challenges in the U.S.-China Relationship, and brief answers to your questions.